California Leaf-Nosed Bat (*Macrotus californicus*)

Photo courtesy of Jason Corbett, Bat Conservation International, www.batcon.org.

Legal Status

State: Species of Special Concern
Federal: Bureau of Land Management Sensitive
Critical Habitat: N/A
Recovery Planning: N/A

Taxonomy

The California leaf-nosed bat (*Macrotus californicus*) is in the family Phyllostomidae and was originally assigned as a distinct full species (Baird 1858, as cited by Rehn 1904). However, based on morphometrics, Anderson and Nelson (1965) placed California leaf-nosed bat as a subspecies of Waterhouse's leaf-nosed bat (*Macrotus waterhousii californicus*), and this was followed by others (e.g., Hall 1981). Based on cranial measurements and chromosomal and biochemical information, California leaf-nosed bat was reassigned to a separate full species *M. californicus* (Davis and Baker 1974; Davis 1973; Greenbaum 1975). Davis and Baker (1974) concluded that *M. californicus* and *M. waterhousii* are "parapatric" species that have contiguous, but non-overlapping distributions. *M. californicus* is currently accepted as a separate species (Wilson and Reeder 2005). A physical description of the species can be found in Wilson and Ruff (Brown 1999).

Distribution

General

The California leaf-nosed bat occurs from southern Nevada and Southern California east to Southern Arizona and south to northern Sinaloa, southwestern Chihuahua, Baja California, and Tamaulipas, Mexico (Wilson and Reeder 2005) (Figure SP-M03). In California, the California leaf-nosed bat occurs in the desert regions of eastern San

Bernardino (i.e., excluding the western Mojave region), Riverside, and San Diego counties and all of Imperial County (Brown and Berry 2004). Although historically the range of California leaf-nosed bats in California reached almost to the southern California coast (Los Angeles/Ventura County line; southern coastal San Diego County, Santa Margarita Ranch [now Camp Pendleton] and DeLuz), the species no longer occurs in these areas, despite repeated searches by bat biologists (Brown and Berry 1998, 2004). Roost disturbance and more important, the loss of suitable foraging habitat have probably led to this regional extirpation (see discussion under Threats and Environmental Stressors). However, even more recent texts do not recognize this loss of range in California in areas outside of the California desert regions that has occurred over the past 60 years (Harvey et al. 2011).

Distribution and Occurrences within the Plan Area

Historical

There are two historical (i.e., pre-1990) occurrences for the California leaf-nosed bat in the Desert Renewable Energy Conservation Plan (DRECP) Area located west of Yuma, Arizona, and north of Interstate 8 (I-8) (Grinnell 1918; Brown et al. 1993a; Brown and Berry 1998, 2004 and 2005; CDFW 2013; Dudek 2013). In writing the bat section of the Bureau of Land Management (BLM) California Desert Plan in 1980, Brown reviewed all historical literature and museum records for bats in the California desert and included her own observations since 1968. (These records occur in the CNDDB as supplied by BLM regardless of the original source.) Brown and Berry (1998, 2004) surveyed 18 historical sites (records more than 60 years old), and of these, 8 (45%) still sheltered California leaf-nosed bats at the time of the surveys. Howell (1920) also noted that this species was common in caves and mines and that the Salton Sea area supported many caves created by wave action of the sea along its historical coastline. Howell (1920) observed up to 300 individuals in a single colony and collected 63 of them. Arnold (1943) observed the species in the winter in mines and powder magazines near the Laguna and Imperial dams in Imperial County, and Huey (1925) observed a colony of about 500 individuals in a mine shaft north of Potholes in Imperial County. Several historical sites for California leaf-nosed bat occur in San Diego

County, including in the Plan Area at the Mollie Mine in Anza Borrego State Park and a natural cave in Flat Cat Canyon (Banks 1965), as well as the Stage Station at Vallecito and the Artery Mine near Dulzura (Krutzsch 1948) west of the Plan Area. Brown and Berry (1998) visited these areas during the 1980s and 1990s, when assessing the current range for California leaf-nosed bats for the California Department of Fish and Wildlife (CDFW), and no California leaf-nosed bats were found.

Recent

There are numerous recent (i.e., since 1990) records for the Plan Area, including 39 occurrences in the California Natural Diversity Database (CNDDB) (CDFW 2013) and four roost sites (Figure SP-M03). Brown (pers. comm. 2012) also has provided many records for California leaf-nosed bat in the California desert region. Brown has surveyed more than 2,500 mines or natural caves in 30 mountain ranges in the desert within the range of California leaf-nosed bat over the past 45 years (Brown 1993; Brown and Berry 1998, 2000, 2004). Mountain range extensions (beyond museum and past literature citations) for this species included the Bristol, Marble, Calumet, Eagle, Pinto, Ship, Old Woman, McCoy, Sacramento and Little Maria Mountains in Riverside and San Bernardino counties. Warm mines (and California leaf-nosed bat) have yet to be discovered in other adjacent mountain ranges (Orocopia, Chuckawalla, Little Chuckawalla, Palen, Granite, Coxcomb, Arica, West Riverside, Turtle, Sawtooth, Piute, Clipper, Sheephole and Stepladder Mountains). During a 1995 survey conducted for the Fort Irwin Expansion (Brown and Berry, unpublished data, as cited by Brown, pers. comm. 2012), a few male California leaf-nosed bats were discovered in May in the "Mud Hills" mine at the north edge of the Avawatz Mountains, just south of Death Valley National Park. Guano attributable to this species was also located in a mine near Amargosa Springs. These records suggest a northward extension of the range of California leaf-nosed bat, and the species might occur in the southern part of Death Valley National Park (Brown, pers. comm. 2012).

Natural History

Habitat Requirements

In the California desert, all of the known California leaf-nosed bat roosts are located below 800 meters (2,500 feet) in elevation and most are within 6 kilometers (4 miles) of desert washes containing ironwood (*Olneya tesota*), palo verde (*Parkinsonia* spp.), smoke trees (*Psorothamnus spinosus*) and/or desert willows (*Chilopsis linearis*) (Brown, pers. comm. 2012). The greatest concentration of roosts and those with the largest bat colonies are within the drainage of (and often within sight of) the Lower Colorado River. The roosts discovered near the south end of Death Valley are located in creosote bush scrub. Historical roosts (before development) near coastal areas of California were in chaparral or oak woodland (Brown, pers. comm. 2012).

The California leaf-nosed bat is primarily a cave and mine dwelling species (Anderson 1969; Arita 1993; Arnold 1943; Brown and Berry 2003, 2004; Howell 1920), but also occasionally occupies buildings (Anderson 1969). In Arizona, they have also been found in "open" bridge structures that have cave-like chambers at either end (Davis and Cockrum 1963; Brown and Berry 2004), but most bridge structures are unlikely to be suitable as day roosts. California leaf-nosed bats have been observed using buildings as night roots east of Searchlight, Nevada (Hatfield 1937) and at Cibola National Wildlife Refuge in California (Brown and Berry 2003). Most winter roost sites in California are mine tunnels at least 100 meters (328 feet) long (Brown 2005). Roost chambers often have large ceilings and considerable fly space (Anderson 1969), although smaller drifts are also used. California leaf-nosed bat is the most northerly representative of the Phyllostomidae, a predominantly Neotropical family. This species neither hibernates nor migrates, and it is incapable of lowering its body temperature to become torpid. Bell et al. (1986) conducted a series of experiments in the laboratory to measure energy metabolism, thermoregulation and water flux to determine if special physiological adaptations allowed California leaf-nosed bats to remain active yearlong in the temperate zone. In the field, daily energy budgets for free-ranging bats were determined using the doubly-labeled water technique. California leaf-nosed bat has a relatively narrow thermal neutral zone, with the lower critical temperature near 34 degrees Celsius (93 degrees Fahrenheit) and the upper near 37 degrees Celsius (98.6 degrees Fahrenheit). No special physiological adaptations were found in California leaf-nosed bat for desert existence (Lu and Bleier 1981), and they appear to adapt behaviorally rather than physiologically by roosting in geothermally heated winter roosts that have a stable year-round temperature of about 27 degrees Celsius (81 degrees Fahrenheit) (Bell et al. 1986; Brown 2005; Brown and Berry 1998, 2004). Summer roosts may be in more shallow natural rock caves and mines since the summer desert temperatures close to the openings exceed 40 degrees Celsius (104 degrees Fahrenheit) (Brown 2005). Summer roost sites are not always completely dark, and individuals may roost within 10 to 30 meters (33 to 98 feet) of the roost opening. California leaf-nosed bats are tolerant of the highly ammoniated atmosphere of many caves and mines and can tolerate higher concentrations than humans (Mitchell 1963).

California leaf-nosed bats forage in riparian and desert wash areas in California, Arizona, and Nevada (Brown 2005; Huey 1925; Williams et al. 2006) and at tinajas (water-carved natural rock pools) and manmade tanks in southwestern Arizona (Rabe and Rosenstock 2005; Schmidt 1999). Williams et al. (2006) observed California leaf-nosed bats generally using riparian marsh, mesquite bosque, riparian woodland, and riparian shrubland without any apparent differential selection. The tinajas in the Rabe and Rosenstock (2005) study provided open flight approaches and were located near suitable roosting sites (cliffs and rocky canyons). For California, suitable foraging habitats are desert riparian, desert wash, desert scrub, desert succulent scrub, alkali desert scrub, and palm oases (Brown and Berry 2004; Zeiner et al. 1990). In the Sonoran Desert of Arizona (where desert trees are not confined to drainages), a greater percentage of the landscape is utilized by foraging bats (Brown et al. 1999; Dalton et al. 2000; Dalton 2001).

Roosting and foraging habitat associations for the California leaf-nosed bat in the Plan Area are shown in Table 1.

Table 1. Habitat Associations for California Leaf-Nosed Bat

Land Cover Type	Habitat Designation	Habitat Parameters	Supporting Information
Mines and Caves and occasionally buildings	Roosting	Mines within the California Wildlife Habitation Relationship distribution map boundaries.	Anderson 1969; Zeiner et al. 1990; Brown and Berry 2004
Riparian woodlands desert wash, desert scrub	Foraging	Riparian woodlands, desert wash, desert scrub within 6.2 miles of mines.	Williams et al. 2006; Zeiner et al. 1990; Brown and Berry 2004

Foraging Requirements

California leaf-nosed bat appears to be primarily insectivorous (Anderson 1969). Prey for California leaf-nosed bat include Orthoptera (crickets and grasshoppers), Lepidoptera (butterflies and moths), Coleoptera (beetles), Homoptera (cicadas), and Hymenoptera (ants) (Anderson 1969; Huey 1925; Ross 1961), but at least occasionally takes small vertebrates. Brown (Brown and Berry 2003, 2004) discovered a California leaf-nosed bat in a night roost chewing on the head of a wiggling tree lizard (*Urosaurus ornatus*). Since that time Brown has seen other California leaf-nosed bats carrying tree lizards into night roosts. This reptile spends most of its time in trees and scrubs, often clinging head downward (Stebbins 1985). The California leaf-nosed bat probably gleaned it from the branches of a desert tree when the lizard was sleeping. They are vegetation gleaners and likely take prey directly from the ground or vegetation because some of their prey are flightless and sometimes diurnal (butterflies and lizards) (Stager 1943; Brown and Berry 2004; Anderson 1969; Bell and Fenton 1986). They have short, broad wings that allow them to fly slowly while foraging, with high maneuverability (Anderson 1969; Vaughan 1959), but they are also capable of fast flight with measured speeds of 12 to 14 miles per hour (Dalton 2001; Hayward and Davis 1964). They probably use a combination of echolocation, prey-produced sounds, and binocular vision to locate terrestrial prey (Bell 1985; Bell and Fenton 1986). Their eyes are positioned more anteriorly, and they have superior vision compared to other bats (Bell and Fenton 1986). They usually emerge from day roosts 90 minutes to

2 hours after sunset during the summer and forage in two main bouts during the night (Anderson 1969). During the winter, they may emerge around sunset or shortly after (e.g., within 30 minutes) and forage for about 2 hours (Brown 2005). They may use night roosts that are different from their day roosts (Anderson 1969; also see Hatfield 1937 for use of buildings as night roosts). In the summer, they will roost in desert trees with the foraging area as determined by radio-telemetry (Brown et al. 1999; Dalton et al. 2000).

Reproduction

The largest roosts (over 1,000 individuals of both sexes) are formed in the winter in warm mines. Segregation of males and females usually occurs in the spring and summer, although a few males remain in the maternity colonies. Females congregate in large (>100 bats) maternity colonies, although colonies of only 6 to 20 bats are also found (Barbour and Davis 1969; Vaughan 1959; Brown and Berry 2004). They utilize different mines or areas within a mine separate from those occupied in the winter. Within the larger colonies, clusters of five to 25 females will be associated with a single "harem" male that defends the cluster against intruding males (Brown and Berry 1991). The single young (weighing 25-30% of the mother's mass) is born between mid-May and early July (following a gestation of almost 9 months) and young are weaned by August (Anderson 1969; Bleier 1975; Bradshaw 1962; Carter and Bleier 1988; Brown and Berry 2004). Since the newborn bats are poikilothermic (a body temperature that fluctuates with the immediate environment), the maternity colony occupies areas close to the mine or cave entrance, where temperatures exceed 32 degrees Celsius (90 degrees Fahrenheit) and daytime summer outside temperatures reach over 49 degrees Celsius (120 degrees Fahrenheit). Most maternity roosts have multiple entrances that allow warm air flow through the mine.

Maternity colonies disband once the young are independent in late summer and breeding occurs in the early fall (Anderson 1969; Brown and Berry 1996). The reproductive cycle of these bats as studied by Krutzsch and others (Krutzsch et al. 1976; Crichton and Krutzsch 1985; Bodley 1974; Bleier 1975; Bradshaw, 1962) shows that viable sperm is not present in the male reproductive tract until August. Ovulation occurs in September and October (Bleier 1971), and unlike many other bat species that store sperm over the winter and delay fertilization, fertilization occurs immediately after mating, and implantation occurs in later October and November to January (Bleier 1971; Carter and Bleier 1988). Gestation is 8 to 9 months and includes about a 4.5-month diapause period when growth and development is slowed (Bleier 1971; Bleier and Ehteshami 1981; Bradshaw 1962; Crichton and Krutzsch 1985; Crichton et al. 1990). Growth rate and diapause is under control of the hormone progesterone (Crichton and Krutzsch 1985; Crichton et al. 1990). In March, with increased temperatures and insect availability, embryonic development accelerates. Females are reproductively active in their natal year, but males become sexually mature in their second year (Carter and Bleier 1988). Longevity is at least 15 years, based on banding studies (Brown 2005).

In the fall, males aggregate in display roosts and attempt to attract females with a courtship display consisting of wing flapping and vocalizations . The areas used as "lek" sites are usually in or near a mine that had been occupied by a maternity colony (Berry and Brown 1995; Brown and Berry 2004), although exceptions exist. The lek site at Cibola Bridge is located over 11 kilometers (7 miles) from the roost at the Hart Mine (Brown and Berry 2003). In some mines, males defend specific calling areas, while at other sites they will display alongside other males. Aggression between males occurs at this time. Females enter the areas throughout the night, usually roosting in separate groups before approaching a male (Berry and Brown 1995). A banded male observed in the Queen Mine in the Cargo Muchacho Mountains (Imperial County) in September 1994 did not leave the mine during the night, and copulated with at least four females during this period (Brown, pers. comm. 2012). Since the majority of roost surveys have been conducted in the winter and summer, the fall courtship areas for California leaf-nosed bats have not been determined for most mountain ranges.

Key seasonal periods for the California leaf-nosed bat are summarized in Table 2.

Table 2. Key Seasonal Periods for California Leaf-Nosed Bat

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Reproduction				x	x	x	x	x				
Mating									x	x		
Wintering	x	x	x								x	x

Notes: Seasonal migration may occur between mountain ranges.
Sources: Anderson 1969; Bleier 1975; Bradshaw 1962; Brown and Berry 2004

Spatial Activity

California leaf-nosed bats are year-long residents in California (Anderson 1969; Brown and Berry 2004), although historically the species may have migrated to Mexico in the winter (Grinnell 1918) prior to the availability of abandoned mines. Bell et al. (1986) concluded that behavioral adaptations such as foraging methods and roost selection contributed to the successful exploitation of the temperate zone desert by California leaf-nosed bat.

The annual mean temperature in the California desert in the range of California leaf-nosed bat is approximately 23 degrees Celsius (73 degrees Fahrenheit) and the mean winter temperature is 14 degrees Celsius (57 degrees Fahrenheit). All known winter roosts in the deserts of California, Arizona and southern Nevada exhibit stable temperatures greater than 27 degrees Celsius (81 degrees Fahrenheit) and relative humidities above 22%. These mines appear to be located in geothermally-heated rock formations of moderate temperature (Higgins and Martin 1980). California leaf-nosed bats inhabit a stable warm environment (except during their short winter foraging periods). Roost site use does vary seasonally, however, with mixed male/female roosts in the winter and mostly segregated, large, female maternity roosts and smaller, dispersed male roosts during the spring through summer reproductive season (Anderson 1969; Brown 2005), indicating at least local seasonal movements and roost use related to reproduction. Banding studies conducted over the past 43 years suggest that distances traveled between summer and winter roosts are generally no more than a few miles (Brown et al. 1993b;

Brown and Berry 1996). Over 25,000 California leaf-nosed bats from mine roosts along the Colorado River from Parker Dam to Yuma were banded. On yearly trips, usually in the winter, many of these bats were recaptured up to 10 times with an average 50% recapture success rate, suggesting strong roost fidelity, although seasonal movements do occur between roosts. The longest distance between the site of banding and that of recapture was a movement over two mountain ranges for a linear distance of 87 kilometers (54 miles). The greatest time interval so far between initial banding and recapture is 15 years. Assuming that the bat was born in the spring prior to the winter banding, this would indicate a possible longevity of at least 15.5 years. This record for the species is remarkable because long life in bats is usually attributed in some part to their ability to undergo daily and seasonal torpor (Brown, pers. comm. 2012).

There is some information about spatial activity related to foraging. Vaughan (1959) reported that California leaf-nosed bats forage up to 1.3 kilometers (1 mile). Using radiotelemetry, Brown et al. (1993b) observed foraging in desert wash within 10 kilometers (6.2 miles) of roost sites. although more recent data documents captures of California leaf-nosed bats in cottonwood and willow revegetation sites along the Lower Colorado River over 16 kilometers (10 miles) from any potential roosting habitat (Calvert 2009a, 2009b, 2010). As observed by Williams et al. (2006), they generally forage in riparian habitats without any apparent differential selection of riparian type. They also forage at open water sites near potentially suitable roosting habitat (Rabe and Rosenstock 2005). Their ability to fly fast suggests that they could forage fairly far from roost sites. In addition, their selection of limited roosting areas (i.e., primarily temperate caves and mines) suggests that they may be capable of flying quite far to suitable foraging areas that support abundant insect prey, even if most activity is near roost sites (e.g., Williams et al. 2006).

Night roosts are occupied by California leaf-nosed bats between foraging bouts, and may have social significance to the colony. Night roosts are often identified by large amounts of guano and culled inedible insect remains (lepidopteran and orthopteran wings). Bats may return to the same mine used during the day, and roost in different areas. Radio-telemetry studies have shown that individual bats have fidelity to certain night roost sites in shallow mines, rock shelters, buildings, bridges and trees (Brown et al. 1993b; 1999; Brown and Berry 2003; Dalton et al. 2000).

Ecological Relationships

There is some information about ecological associations for the California leaf-nosed bat, but little data for direct or indirect interspecific interactions. It can be found in association with other bat species at roost sites, including pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and myotis species (*Myotis* spp.) in California (Vaughan 1959; Brown and Berry 2003, 2004). Pallid bats and California leaf-nosed bats have similar ecological attributes as both glean large immobile insects and arthropods, and day and night roost in close proximity in mines. Pallid bats cluster in roosts and often use crevices, while California leaf-nosed bats hang alone from the ceiling (Vaughan 1959).

Desert riparian communities are very spatially limited resources used by a large number of bat species. A likely important factor in bat community diversity and ecological relationships in desert riparian areas is resource partitioning. Black (1974) suggested that bats may employ several types of foraging and food partitioning mechanisms that could reduce interspecific competition, including size and type of prey; periods of activity (most bat prey are active within a few hours of sunset, but different prey have different peak activity periods); spatial partitioning, such as between-, within-, and below-canopy foragers; and flight patterns, such as slow vs. fast flying, maneuverability, and hovering. Williams et al. (2006) examined foraging activity by California leaf-nosed bats in riparian habitats in southern Nevada that were also used by 14 other bat species, including both resident and migrant species (see Table 1 in Williams et al. 2006 for the list of species detected). Adequate detection data were collected to analyze habitat use by several of the species. These data show that California leaf-nosed bat, Brazilian free-tailed bat (*Tadarida brasiliensis*), western yellow bat (*Lasiurus xanthinus*), and pallid bat exhibit different habitat selection patterns. While California leaf-nosed bat and Brazilian free-tailed bat were riparian habitat generalists, western yellow bat and pallid bat showed strong preferences for riparian woodland (Williams et al. 2006). Six other bats qualitatively showed more activity in one of the four riparian types (i.e., riparian marsh, mesquite bosque, riparian woodland, and riparian shrubland), indicating some selection. Overall, riparian woodland, which represented less than 1% of the riparian habitat in the study area, was the preferred habitat type (>50% of all bat activity), with riparian marsh the least used, although it was often used by the spotted bat (*Euderma maculatum*). Williams et al. (2006) suggested that habitat preferences by the different bats may reflect preferred insect prey and abundance, indicating a possible basis for resource partitioning. Given that desert riparian communities are a critical resource for bats, the habitat use information provided by Williams et al. (2006) indicates that managing this diverse habitat type, including hydrology and species composition, is important for maintaining a diverse bat community, including suitable habitat for California leaf-nosed bat.

Population Status and Trends

Global: Apparently secure (NatureServe 2011)
State: Vulnerable to imperiled (CDFG 2011)
Within Plan Area: Same as state

Although historical records from 1894 through 1950 place California leaf-nosed bat in more coastal sections of southern California, these sites are not currently occupied (Grinnell 1918; Howell 1920; Constantine, 1961, 1998; Brown and Berry 1998, 2004), representing a loss of almost 50% when polygons are drawn between historical and current roost areas in California. Urbanization, human disturbance of roosts and destruction of foraging areas are probably the primary factors in their eradication from these areas. With possibly one exception, all California leaf-nosed bat roosts are now located in the desert.

The California leaf-nosed bat is a former U.S. Fish and Wildlife Service (USFWS) Category 2 Candidate for listing under the federal Endangered Species Act and is now a Species of Special Concern for USFWS and the CDFW (Brylski et al. 1998), and a BLM and U.S. Forest Service (Region 5) Sensitive Species. The Western Bat Working Group granted it High Priority for its entire range. www.wbwg.org/speciesinfo/species_matrix/spp_matrix.pdf).

Information collected by Ellison et al. (2003) for California leaf-nosed bat suggested that assessing population trends for this species would be a challenge. Ellison et al. (2003) reviewed information for 143 locations in Arizona, Nevada, and California. Counts at occupied sites ranged from 1 to 2,000 individuals. Trends were analyzed for five colonies, including three winter colonies and two summer colonies, and no positive or negative population trend was apparent. They also noted that the number of individuals at roost sites can fluctuate both between and within seasons, so population sampling would need to account for this apparent natural temporal variation. Ellison et al. (2003) noted, however, that many reports lacked careful and consistent documentation of surveys methods, such as how counts were made, what type the colony was, etc. More recent censuses using standardized methods has revealed stable colony sizes for California leaf-nosed bats in the largest colonies. Over the last 10 to 12 years Brown has conducted censuses by counting exiting bats in the evenings with night vision equipment in the same manner and at the same times of year in the absence of moonlight (Brown 2011). These are usually done in the winter (January or February) when the largest colonies form and for maternity colonies in mid-April or May (prior to young of the year flying). Moon phase was recognized as a significant variable in determining population size by exit counts for California leaf-nosed bat in January 2003 when paired counts were conducted during the week before and after the full moon on selected mines in southeastern California (Brown and Berry 2004; Brown 2011). There was a several-fold increase in the number of bats exiting the mine in the hour after dark in the absence of moonlight. These studies by Brown underscore the need for standardized census methods and consideration of detectability factors to document any population trends.

Threats and Environmental Stressors

The two main threats to this species likely are (1) disturbances of roost sites due to human entrance, abandoned mine closures, and renewed mining in historic districts (Brown 2005; Zeiner et al. 1990) and (2) loss and degradation of desert riparian habitats (Brown 2005). Brown (Brown 2005; Brown and Berry 1998, 2004) cites the loss of desert riparian habitat to development of golf courses and residential housing in the Coachella Valley and the "rip rapping" and channelization of desert washes as a threat to the species. Ground water pumping and road construction that alters drainage patterns can negatively impact microphyll woodland and desert wash vegetation. Another potential threat is direct or secondary poisoning and loss of prey related to pesticide use for agriculture and golf course operations, and other environmental contaminants associated with mining (Clark 1981; Clark and Hothem 1991).

Several recent studies have documented substantial mortality of bats at wind facilities (e.g., Baerwald and Barclay 2009; Cryan 2011; Cryan and Barclay 2009). A general review of the wind facility–related literature failed to reveal evidence for, or discussions of, California leaf-nosed bat fatalities or assessed risks at wind facilities (e.g., Baerwald and Barclay 2009; Cryan 2011; Cryan and Barclay 2009; Cryan and Brown 2007; Kuvlesky et al. 2007). This is likely because of the species' limited range in the southwestern United States and, further, because relatively little systematic post-project bat fatality monitoring data have been collected for large wind energy projects in the southwest (Solick and Erickson 2009). However, California leaf-nosed bats in the Plan Area could be at elevated risk of turbine strikes or from other associated causes (e.g., barotrauma) if a wind facility was located within a few miles of a day roost site (where most foraging activity occurs) and strikes would most likely occur during emergence and return to the day roost. Risk of strikes may also be higher when bats are moving between maternity roosts and winter sites in the fall and spring.

Conservation and Management Activities

California leaf-nosed bat is addressed in the West Mojave Plan (BLM 2005) under Alternative A (the Proposed Action – Habitat Conservation Plan). The BLM would implement several conservation measures for California leaf-nosed bat, including:

- Protection of all roosts containing more than 10 California leaf-nosed bats (Notes: The Plan identified one maternity roost and one maternity/winter roost for the species. Also, the Plan refers to "maternity and hibernation" roosts, but California leaf-nosed bats do not hibernate (Brown, pers. comm. 2012) so reference to these roost types was deleted);

- Continued fencing around (but not over) open, abandoned mine features to provide bats access to roosts and to reduce hazards to the public;
- Required surveys for bats by applicants seeking discretionary permits for projects that would disturb natural caves, cliff faces, mine features, abandoned buildings, or bridges to determine whether significant roost sites are present; and
- Safe eviction of bats at a non-significant roost (i.e., fewer than 10 individuals) prior to disturbance or removal.

BLM would also conduct monitoring and adaptive management for California leaf-nosed bats. Monitoring actions include:

- Determining bat numbers in all significant roosts (defined by BLM for the West Mojave Plan as more than 10 individuals);
- Conducting periodic surveys of mine openings in Pinto Mountains for bats in areas with high potential for containing significant roost sites;
- Determining and reporting the effectiveness of mitigation measures providing for safe exit of bats;
- Reporting take from approved projects that impact bats under to the CDFG and USFWS; and
- Monitoring population numbers using bat houses if installed (Note: Brown (pers. comm. 2012) indicates that California leaf-nosed bats would not use bat houses, but this is included as conservation measure in the West Mojave Plan).

Adaptive management measures include:

- Gating mines where new significant roosts are found;
- Installing bat houses in locations, where appropriate, if populations decline or are threatened (Note: Brown (pers. comm. 2012) indicates that California leaf-nosed bats would not use bat houses); and

- Desert wash vegetation within 3 miles of known or newly discovered maternity and hibernation roosts of California leaf-nosed bats would be protected. Motorized vehicle use of washes in these locations would be assessed on a case-by-case basis to determine if vehicles harm the desert wash vegetation. If substantial damage from vehicle use is determined to be present, alternative access routes would be developed and the wash routes would be closed or limited. (Note: California leaf-nosed bat does not hibernate (Brown, pers. comm. 2012), but the West Mojave Plan refers to hibernation roosts).

The California leaf-nosed bat is also addressed in two other BLM plans for the California desert. The *Proposed Northern and Eastern Mojave Desert Management Plan* addresses sensitive bats, including California leaf-nosed bat (BLM 2002a). Under the proposed alternative, this plan includes changing the existing "Moderate Multiple Use Classification" to the "Limited" designation for 7,400 acres of public land in the Silurian Hills region, which is known to support extensive habitat for several sensitive bat species. Route designation would occur on these lands, including seasonal limitations and/or closures to sensitive bat values (e.g. active bat maternity roosts).

The *Proposed Northern & Eastern Colorado Desert Coordinated Management Plan Activities* (BLM 2002b), under all alternatives, would require mitigation measures for projects authorized at or within 1 mile of a significant bat roost site, which may include seasonal restrictions, light abatement, bat exclusion, and gating of alternate sites. If bats are to be excluded from an old mine prior to renewed mining, the exclusion must be performed at a non-critical time by a qualified bat biologist. Mitigation plans for large mines would consider retaining some shafts and adits (horizontal or nearly horizontal opening to a mine) or creating new ones as compensation. Also, under the proposed alternative, Bat gates would be constructed on caves or mine roosts only where there is significant potential for negative effects and closure of any route within 0.25 mile of any significant bat roost would be strongly considered.

In addition, as a BLM sensitive species, California leaf-nosed bat is addressed under other land use actions undertaken by BLM. In accordance with BLM's "6840 – Special Status Species Management" manual, the objectives for sensitive species policy are:

> To initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (BLM 2008).

Under this policy, BLM must consider the impact of actions on sensitive species, including outcomes of actions (e.g., land use plans, permits), strategies, restoration opportunities, use restrictions, and management actions necessary to conserve BLM sensitive species.

The California leaf-nosed bat is covered as an "evaluation species" under the Lower Colorado River Multi-Species Conservation Program administered by the Bureau of Reclamation (LCR MSCP 2004). The LCR MSCP defines evaluation species as species that could be listed in future years and that could be added to the covered species list during LCR MSCP implementation, but for which sufficient information was not available for LCR MSCP planning area when the plan was prepared. Conservation measures include: (1) conducting surveys for roost sites within 5 miles of the LCR MSCP planning area in Reaches 3–5; and (2) creating habitat near roost sites, including cottonwood-willow and honey mesquite within 5 miles of roost sites.

California leaf-nosed bat is also addressed in the Military Integrated Resource Management Plan (INRMP) for the Marine Air Ground Task Force Training Command, Marine Corps Air Ground Combat Center, Twentynine Palms (MAGTFTC MCAGCC 2007). As a designated sensitive species in the INRMP, California leaf-nosed bat is provided protection and management considerations for the military training operations at Twentynine Palms. If it is determined to be at risk from training activities, efforts are made to avoid and minimize impacts. For example, four bat gates have been installed in three mines to allow bats access to roosts without disturbance from humans. The Twentynine Palms INRMP also includes three objectives:

- Monitoring current bat gates to inspect for trespass and condition;
- Evaluating mine entrances for installation of bat gates to those mines that are exceptional bat habitat but not culturally significant; and

- Evaluating modification of bighorn sheep guzzlers for use by bats and other wildlife to enhance habitat value.

Data Characterization

There is substantial information for the distribution of California leaf-nosed bat and its use of mines and caves in the Plan Area. Brown has surveyed more than 2,500 mines or natural caves in 30 mountain ranges in the desert within the range of California leaf-nosed bat over the past 45 years (Brown 1993; Brown and Berry 1998, 2000, 2004).

Management and Monitoring Considerations

The main management consideration for California leaf-nosed bat is the relationship between human activities near active roost sites, (mine entry by recreation, geologists, etc.), and mine closure for hazard abatement or renewed mining (Brown 2005). Removal of desert wash vegetation near a roost will cause declines (Brown and Berry 1995). Management of riparian communities with regard to hydrology and community structure is also an important management concern (Williams et al. 2006). Pesticide use in agricultural areas or golf courses adjacent to suitable roosting and foraging areas should be managed to prevent potential direct and indirect poisoning and secondary impacts on prey.

Predicted Species Distribution in the Plan Area

This section provides the results of habitat modeling for California leaf-nosed bat, using available spatial information and occurrence information, as appropriate. For this reason, the term "modeled suitable habitat" is used in this section to distinguish modeled habitat from the habitat information provided in Habitat Requirements, which may include additional habitat and/or microhabitat factors that are important for species occupation, but for which information is not available for habitat modeling.

There are 8,046,536 acres of modeled suitable habitat for California leaf-nosed bat in the Plan Area. Appendix C includes a figure showing the modeled suitable habitat in the Plan Area.

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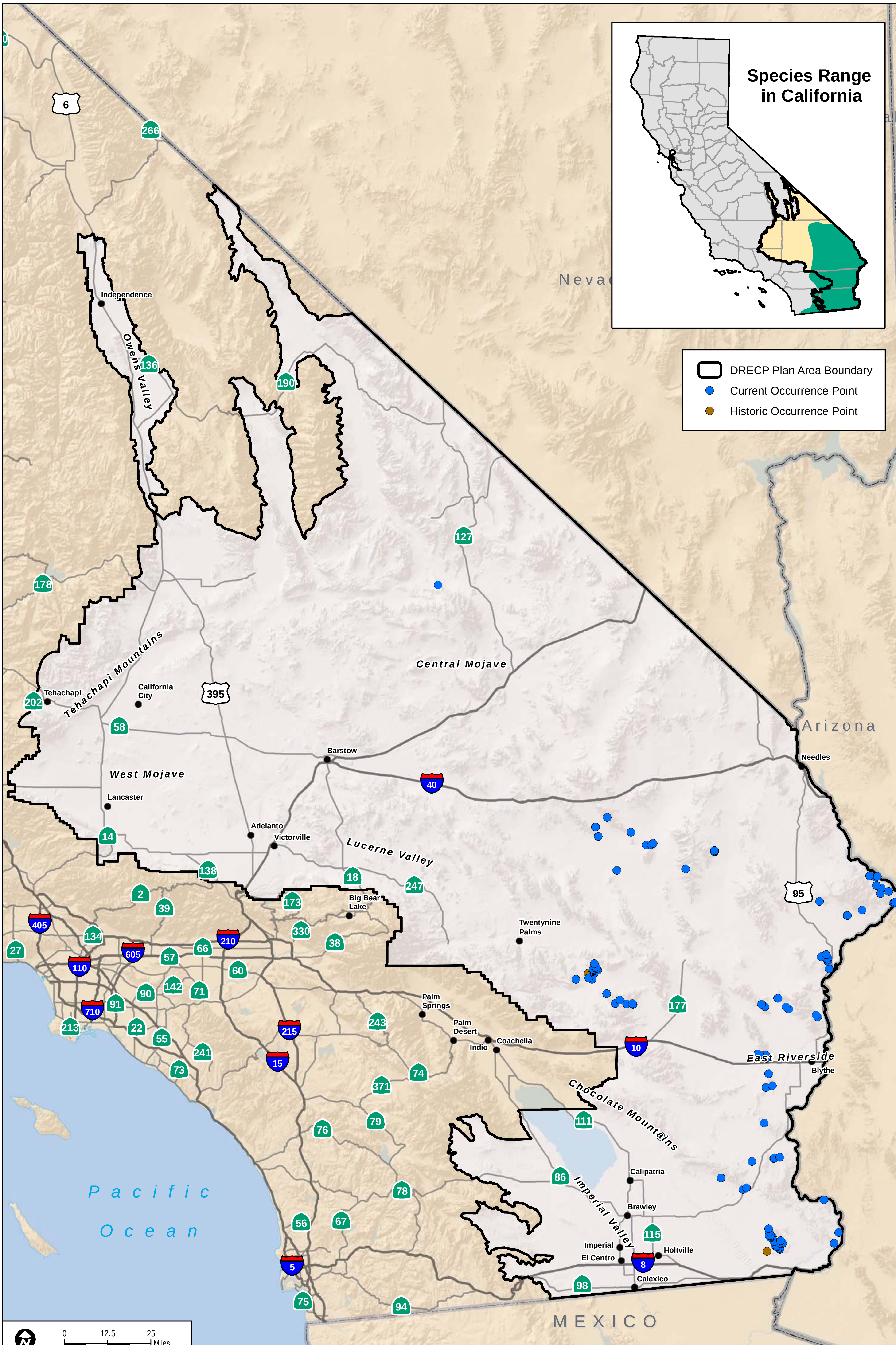

Sources: ESRI (2014); DRECP Species Occurrence Database (2013), CWHR (2008)

FIGURE SP-M03
Leaf-nosed Bat Occurrences in the Plan Area